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Cyclic Vomiting in Children, with Report of Cases.

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All neuroses necessitate an exclusion of organic disease, a most difficult task, and an appreciation of an unusual excitability of the nervous system. Of all the various gastric neuroses, secretory, sensory and motor, with their protean manifestations, none are subjects of greater interest than the motor and, though perhaps of less frequent occurrence, none of the motor of more interest than cyclic vomiting.

The mechanism of vomiting includes a vomiting center, situated in the medulla near the respiratory center; from which impulses are sent to the diaphragm by the phrenic nerves, to the stomach and esophagus by the pneumogastric and to the abdominal muscles by the intercostal nerves. The complex act consists in an inspiration, the glottis closing, the diaphragm contracting, the longitudinal fibers of the stomach opening its cardiac orifice, when contraction of the abdominal muscles completes the act, forcing out the stomach contents. The muscles of the diaphragm, of the abdominal walls, of the stomach itself require simultaneous contraction and must be co-ordinate by a relatively strong nerve center. The process is almost physiological. Act of the will quite controls eructation, or belching of gas from the stomach and, in some instances, regurgitation or bringing up liquid or solid food from the stomach. Individuals have been able to vomit at will.

In the condition known as merycism or rumination, swallowed food is returned and chewed over again. Poorly masticated food may be returned and even enjoyed at will, says one writer.

With these strange exceptions, however, unlike a physiological process, the nervous and vascular systems are always reduced in power, probably not only by the act, but by the morbid process which produces the condition, acting on other parts of the nervous system than the vomiting center.

The differentiation of the causes of vomiting in children fre-

quently presents difficulties. The causes are varied, children give little or no history, and the practitioner must grope his way much as the veterinarian. Called for the first time, or in the first attack, to a child with excessive vomiting, with little or no history, we wish to call attention to a class of cases to which such vomiting may belong, and the differentiation of such cases from other attacks of vomiting in children.

The attacks which are herein described occur in gouty and neurotic children and are due to toxins from faulty metabolism and faulty kidney elimination. The attacks are distinct neuroses, being due to the action of a toxin on the vomiting center in a predisposed subject.

Such neuroses have been described at length in literature by Holt, Rotch, Pepper, Griffith, Gee and other writers. The distinctive feature of this gastric neurosis, cyclic vomiting, is that it occurs in a certain type of children, gouty and neurotic. Cyclic vomiting has been likened to migraine in its tendency to recurrence or periodicity. Prostration is extreme. Death has been reported in two instances. One other case of death unreported has been brought to my notice by Dr. C. J. Seltzer, in which all known remedies were of no avail.

The vomiting is excessive, severe, protracted, and nothing can be retained by the stomach. Thirst is likewise excessive and distressing. There is no connection in an attack with diet or indigestion. There is generally a fever of indefinite type. Abdominal symptoms are quite immaterial and varied. The abdomen is generally about normal in appearance. There may or may not be constipation. The urine presents the most distinctive feature, being loaded with amorphous urates and uric acid crystals entirely out of proportion to the fever and other phenomena. Closer study of the urine in all cases may reveal the true cause, possibly blood examinations assisting.

The following case-histories illustrate the condition:

A boy of 6, well nourished, whose father is subject of arteriosclerosis, and whose mother suffers with recurrent attacks of migraine. The patient had been subject to attacks generally of no longer intervals than 8 months. The prodromes of the attacks were generally malaria, headache, and disgust for food and soreness of the abdomen, with some rise of temperature. The attacks of vomiting were sudden, several occurring every one-half or 2 or 3 hours, and lasting for several days, till the child was completely exhausted. The fever continued throughout the attack. Convalescence was rapid. The urine was always loaded with excessive amorphous urates and uric acid crystals. The treatment consisted of calomel 1-10 grain, dry on tongue, every hour till 10 doses; cocaine, gr. 1-2 in 24 hours, given at 1-4 hour intervals; later, sodium phosphate. Restored health.

Girl of 7. Pale, round shouldered and of sickly appearance. Both parents were near the age of fifty at her birth and both are of marked neuropathic type. Her diet is always carefully regulated. Cold has precipitated an attack. There has never been a history of indigestion or constipation, no acid eructations, foul breath, coated tongue or bad taste in the mouth, preceding an attack. Skin, conjunctiva and stools are about normal and there is generally no gaseous distension of the bowels. The prodromes were heavy eyes, with dark rings beneath, no disposition to play, but rather to rest, lying down most of the day. Vomiting began suddenly. The child insisted on having the basin constantly at hand, saying every few minutes, "I am going to vomit," and retching violently. The blood was not examined. The urine was loaded with uric acid crystals and amorphous urates. Cocaine was given in large doses, gradually decreasing, and controlled the attacks with calomel in 1-10 grain doses, as before, dry on the tongue; and followed by sodium phosphate, and later by compound syrup of the hypophosphites. Convalescence was established.

Girl, aged 9 years. Of gouty family, attack precipitated by grief over death of her mother. Mother's death caused by chronic interstitial nephritis revealed at the autopsy, urinary findings having been absent till the fatal uremic issue. The child was of a very affectionate temperament, the pupils filled eyes, and she had a highly developed and easily irritated sympathetic nervous system. Attacks began with nausea and slight vomiting for a time followed by attacks which were violent and persistent, occurring almost every hour. Temperature ranged from 99° to 101° F. Vomited material consisted of frothy mucus and serum, very acid. The blood was not examined. The urine was loaded with excessive uric acid crystals and amorphous urates. At the end of the third day the face was pinched, heavy black rings under the eyes, eyes half closed, body quite drained of fluids and condition one of prostration and collapse. The pulse was 160 and very weak, requiring digitalis and strychnine hypodermically. The tongue was singularly clear and red. The abdomen was neither distended nor flattened, but about normal, although auscultation revealed an absence of peristalsis. There was present distressing thirst and hurried and irregular respiration, though hurried respiration, particularly at the time of vomiting should have little significance, owing to the proximity of the respiratory and the vomiting center. The treatment consisted of high enemas of saline solution and a hypodermic injection of morphine 1-18 gr. and atropine 1-500 gr. The diet consisted of panopeptone. The duration of the acute attack was five days. The after treatment was symptomatic, consisting of sedatives, eliminatives and tonics. During convalescence itching skin and eczematous rash over the buttocks suggested a blood irritant of the uric acid series Thirteen weeks followed of irregular pulse and slightly elevated temperature, from 99° to 100° F., with no other explanation than a marked disturbance of metabolism. This case seems to be properly classified as of the cyclic vomiting type, though there may never be a recurrence, for all necessary factors for recurrence may never again be present as in this instance of emotion from an unusual cause.

Differentiations from Other Attacks of Vomiting.

A condition most likely to be confounded with this gastric neurosis is the more ordinary recurrent bilious vomiting. The points of distinction are these:

Bilious Vomiting.	Cyclic Vomiting.
1. History improper feeding.	1. No such history; may occur with most careful diet with no symptoms of indigestion.
2. Unloading the bowels relieves.	2. No such effect.
3. Tongue coated.	3. May be clean.
4. Breath heavy.	4. Breath late in attacks may have wine odor of acetone, but otherwise normal.
5. Abdomen bloated and distended.	5. Generally about normal.
6. Abdominal pain and colic.	6. As rule, none.
7. Abdominal peristalsis and with colic.	7. Auscultation of abdomen, especially later in the attack, reveals absence of peristalsis.
8. Stools often clayey.	8. Generally normal.
9. Ordinary febrile urine.	9. Urine scanty and loaded with uric acid crystals and amorphous urates out of proportion to other symptoms.

In cyclic vomiting, in conclusion, the excessive thirst, cyclic character, severity and persistence of the vomiting are quite pathognomonic. A differentiation of other causes of vomiting requires an examination of all the organs.

1. Vomiting may be due to local disease, irritation of the walls of the stomach itself, as in cases of any irritation as of medicine or of food in quantity or quality, overdistension with gas, congested mucous membrane, with irritating secretions, which cases reveal themselves by a study of the relation of vomiting to meals and a study of the material vomited.

2. Vomiting may be due to intestinal causes of quite the same nature as above or to such other abdominal causes as obstruction, peritonitis, appendicitis, which soon present very distinct physical signs and symptoms of these conditions.

3. It may be, also, reflex from other disturbance, as of cerebrospinal system or of the special organs,—from brain disease, from the pharynx, eye or ear or almost any organ.

4. Vomiting may be central or toxic from an irritating state of

the blood acting on the vomiting center, in the same manner as a hypodermic of apomorphine. This would include: Infectious diseases, which soon express themselves by well known symptoms or rashes and the vomiting is generally neither prolonged nor excessive and very frequently consists of but one or two explosive efforts. Among other causes of central vomiting may be included the toxemia incident to kidney disease.

In the vomiting of children it is always wise to follow two rules: (1) to examine the throat carefully, and not to be easily convinced that the cause is local, and (2) to determine whether there is an irritated or diseased stomach. Very frequently it is not at all of gastric origin.

The stomach, organic brain disease and organic kidney disease may represent the most frequent causes.

G. B. Butler says, "Vomiting is sometimes seen as the only marked symptom of an apparently slight nephritis. In such cases its onset is abrupt, its course intense and its outcome not infrequently fatal."

5. Simple or tuberculous meningitis may present greater difficulties, especially when we consider that vomiting may be rarely the only symptom of such a meningitis till a fatal issue by convulsions. The condition of the pupils, the eye grounds, irregular pulse and respiration assist the differentiation.

In the periodical vomiting which occurs in cases of tabes dorsalis in adults, a possible history of syphilis, the symptoms of station and patellar reflex and ocular symptoms are so characteristic that they cannot be confounded and are mentioned only because articles upon periodical vomiting refer to such neuroses, which are in no way related to cases of periodical vomiting now considered.

Other attacks of periodical vomiting, with abdominal pain, in adults, have been described in literature, but have none of the marked features of these attacks.

Still other conditions described as periodical attacks of vomiting in children are very plainly recurrent bilious attacks, in children careless of diet and hygiene, which have been described.

That the phenomena of cyclic vomiting are due to some toxic blood state seems certain, the exact nature of the toxin remaining in obscurity. It may be allied to the unknown toxin of uremia. It is probably of the xanthin series, one of the uric acid group.

The attacks resemble the so-called uric acid storms, described so graphically by Haig, in that the extremities are cold, glandular secretions decreased, and scanty urine and large excretion of substances regarded as uric acid.

The attacks differ in the fact that there is no headache or mental depression, and in the character of the pulse, which is not usually of high tension but weak and irritable like the pulse of toxin poisoning.

It is a pulse which can in no way be explained by the tension caused by impeded capillary circulation, which a colloid state of uric acid may occasion.

The symptoms are not so much of uricacidemia and the clogging of capillaries as of some toxin, possibly of the uric acid series, acting directly on the vomiting center.

The impressibility of certain nerve centers, and the difference of susceptibility of particular nerve centers in particular individuals help to explain the phenomena.

It is well known that toxins of the alloxuric group irritate particularly nerve centers, and that uric acid products are particularly injurious to nerve tissues, and we may be warranted in the assumption that some of these chief products of waste metabolism irritate the vomiting center in this gastric neurosis, though we do not know the steps of the biochemical process or the exact toxin. In all three cases, there is a neurotic or gouty, or a neurotic and gouty family history. In all three cases, the presence of amorphous urates and uric acid crystals in excessive proportion to the febrile disturbance point to a toxin of the uric acid series. In each instance, the alimentary tract and accessory glands seemed fairly normal and the auto-intoxication seemed not of intestinal origin but cellular, with perhaps faulty kidneys.

When we consider how little we know of the toxin of uremia, a condition more pronounced, more serious and more frequently at hand for study, we need not be chagrined at our lack of exact knowledge of the toxin in this gastric neurosis.

The treatment is sedative and eliminative. The indications are: First, to lessen the irritability of the vomiting center; and second, to eliminate. The first has been attempted by bromides and chloral by the bowel, which is not satisfactory. Nothing is so effective as hypodermics of morphine and atropine in severe cases. In less severe cases, cocaine and Fowler's solution lessen irritability both of the vomiting center and the peripheral nerve endings in the stomach wall.

Elimination is best accomplished by calomel dry on the tongue in small and frequent doses, in conjunction with high saline enemas.

Gavage has effected good results in young children. No other diet than panopeptone or liquid peptonoids should be attempted for several days. In the interval there is indicated abundant fresh air and careful skin activity, exercise short of fatigue, an avoidance of nervous strain and child worry, with an anti-uric acid diet.

In conclusion, I wish to emphasize:

1. The importance of being watchful, on one's guard for the vomiting of this gastric neurosis, distinguishing it particularly from bilious vomiting and the vomiting of kidney disease and reflex vomiting, as of brain disease.

2. In children of gouty and neurotic history, the three cases reported point to a toxin allied to the uric acid series as the possible bloodirritant causing the vomiting.

3. The importance in severe cases of hypodermic injection of morphine and atropine, in conjunction with elimination, by high saline enemas, by gavage and, in extreme cases, hypodermoclysis and even intravenous injections of saline solutions.

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Discussion.

Dr. J. P. Crozer Griffith said: Dr. Ely's paper, with its report of cases, has been very interesting to me, since the subject is one with which circumstances have brought me into somewhat close relation. It was my fortune—or misfortune—to observe 4 instances of this curious disorder up to the year 1900, at which time I published a paper upon the subject. Since then I have seen a very typical case with Dr. Sharpless, of West Chester, and another apparently incipient case with Dr. J. W. Marcy, of Merchantville. The name Cyclic, although striking and easily remembered, is, I think, not to be preferred. A cycle indicates some definite regularity in occurrence. This is not true of the affection under consideration. The word Periodical as a prefix also implies a certain regularity in return of the attacks. The name Persistent Vomiting, as it has been called by Rotch, may occasion some confusion, and it does not imply any tendency to return. It seems to me, therefore, that the title Recurrent Vomiting, applied to the condition by Gee, is perhaps the best one yet employed. The etiology of the disease is a most interesting problem. As yet we are more or less in doubt regarding it. Dr. Ely's cases indicate that the affection may depend upon some condition allied to, or identical with, gout. An interesting paper by Comby, in the January number of the *Archives de Médicine des Enfants*, on Arthritism in Children

expresses this same view, and gives recurrent vomiting as one of the manifestations of gout in the digestive apparatus. My own belief has been, and still is, that the affection is a neurosis, but that it is one of a toxic nature. Some poison the result of faulty metabolism becomes stored up in the system until, without discoverable reason, or sometimes depending upon some such exciting cause as overexertion, nervous strain, or the like, there is, so to speak, an overflow of the toxic agent, and the attack develops. The nature of this poison is obscure. Inasmuch as we are no longer even sure that gout is due to uric acid, or that uric acid is itself poisonous, we are still more uncertain about the cause of these curious attacks of vomiting, even if we admit that they are gouty. However, that there is some powerful poison at work seems manifest. The occurrence of a terminal nephritis in the last attack of 2 of my cases can be explained in no other way. Recently Marfan, in a paper in the November number of the *Archives de Médicine des Enfants*, has published cases of vomiting which he claims are due to the presence of acetone in the blood. The condition resembles cyclic vomiting in some respects. Acetone has been found in the urine of cases of undoubted cyclic vomiting. It is questionable, however, whether this substance is the cause of the vomiting or only an accompaniment of it. It is certain that the usual symptoms of acetonemia are not those seen in these gastric attacks. The symptoms of the affection are so striking that there are few other diseases with which this one can be confounded. The recurring attacks of violent, uncontrollable vomiting coming on without apparent cause, with the great prostration attending, the tendency to constipation, the absence of decided abdominal pain, the intense thirst, the anorexia, the feeble pulse and sometimes sighing respiration, form a picture, once seen, never forgotten and always dreaded. The occurrence of a second attack makes the diagnosis almost certain, the only condition closely resembling it in symptomatology being the Periodical Vomiting described by Leyden. This disorder, however, is purely a neurosis, being probably in all cases, and certainly in most cases, a manifestation of locomotor ataxia. In it abdominal pain is a very marked and constant symptom. Moreover, it attacks subjects past the age of childhood, who have reached the time of life when tabes dorsalis is most likely to develop. Still another condition could be confounded with it; the Gastric Attacks of Langford Symes, the Recurrent Gastric Catarrh of Soltau Fenwick. This, however, is clearly only an excessive development of the *Embarras Gastrique* of French writers. The attacks of vomiting in this disorder are rarely so severe as in the recurrent vomiting we are considering, and in any case they always clearly depend upon disordered digestion. In the first attack occurring in any given case of recurrent vomiting we have to distinguish the disease carefully from intestinal obstruction. The combination of repeated vomiting with obstinate constipation which often will not yield to medication is alike in each. The diagnosis may at first be impossible. In one of my cases intestinal obstruction had been strongly suspected by the attending physician. Perhaps a final yielding of the constipation, unattended by the relief of the vomiting, or the continued absence of abdominal pain, or the failure of the appearance of bloody mucus from the bowel, may lead us to conclude that we are probably

dealing with a condition primarily gastric rather than intestinal. I shall not take time to go further into the matter of diagnosis. The disease is, of course, to be distinguished from meningitis, from ordinary bilious vomiting, and from the vomiting which often characterizes the beginning of infectious diseases. Dr. Ely has already considered the matter carefully. A word with regard to prognosis and treatment. The prognosis is, on the whole, good, taking the cases as a class, but very dubious for each individual case. That death may occur I have already shown. As the child grows older there is probably a tendency for the disease to disappear. The experience of the profession with this affection is not, however, sufficiently extended as yet to make this certain. One of my cases has now had no attacks for a couple of years. In one of Rachford's cases migraine supplanted the vomiting as the child grew older. Treatment is often entirely unsatisfactory. In some cases nothing whatever appears to do any good. The nature of the affection must be clearly borne in mind, for since the vomiting is nervous in its origin, nothing is to be gained by the use of remedies directed toward a supposedly disturbed condition of the gastric mucous membrane; nor can we expect to stop the vomiting by having the bowels opened, inasmuch as the constipation depends upon the arrested peristalsis. This condition of the intestine is a nervous symptom produced by the same cause which has disturbed the action of the stomach. I am sure that it is a mistake, after the attack has once gotten under way, to devote much attention to the opening of the bowels. No food or medicine should be given by the mouth and the bowels should be reserved for rectal feeding. When, on the other hand, the attack is encountered at the very beginning, then the elimination of the poison may be attempted by procuring a free action of the bowels. I am sure that I have occasionally been able to abort attacks in this way. Of all the remedies to be used during an attack it seems to me that morphine, given hypodermically, affords the greatest hope of benefit. In one of my cases I am convinced that the use of this remedy saved the life of the patient. However, it is certain that some cases will not be benefitted by it in the slightest degree. Chloral and bromides may, of course, be administered by the bowel, but morphine, given in the way I suggest, appears to me to be preferable. In the way of preventing attacks we can do little because we know so little what the cause is. It seems likely that fatigue and overexcitement are active in some instances. These, therefore, must be guarded against. Should the amount of urine secreted diminish and the bowels become sluggish it may be a warning that an attack is imminent. Free purgation by salines and the use of diuretics may then be of service.

Dr. J. Alison Scott referred to the nervous vomiting of the adult and of the child. Almost all were familiar, he thought, with the neurasthenics who were able to do almost anything with their stomachs, to eructate gas, reverse peristalsis and even produce scybala, if necessary. Nervous vomiting in the adult is not followed by such excessive symptoms as described in the cases of Dr. Ely and Dr. Griffith. It produces moderate emaciation and oftentimes the subjects are in a fair degree of robust health. Gout, he believed, was sometimes attended with periodical vomiting. One patient, who had

been frequently seen for some years, is for some days in succession accustomed to vomit in the early morning. The patient is of gouty descent, the parents for 3 generations have been gouty. She suffers from headaches which are relieved in a few minutes after vomiting. Dr. Scott had had personal experience with but one child, the offspring of 2 exceedingly neurotic parents, whose grandparents in addition were gouty. This patient, a little girl, vomited constantly for a week. Treatment seemed of no avail; recovery was uneventful and no recurrence has occurred. In reference to the presence in the urine of amorphous urates and uric acid, he believed that the urine so filled did not of necessity have an excess of uric acid or urates. The presence of uric acid crystals depends upon the acidity of the urine, upon the absence of pigmentation and sometimes upon a very high percentage of uric acid being present. Poverty in other mineral salts will produce uric acid very quickly. Against the theory that the vomiting is gouty, he said that uric acid is usually diminished in gout. It seemed to him probable that the vomiting was the result of uric acid toxins.

Dr. H. S. Anders said that it seemed to him that the effort made to help these cases should be based upon the practical and scientific way of trying to find whether the vomiting was nervous or cyclic, and the specific, definite or direct cause of the vomiting. It is usually considered that the cases purely neurotic in origin were those in which there was the absence of any disagreement of food with the stomach, or in which there was no evidence of organic gastric affection. The presence of gouty and neurotic history combined was helpful in diagnosis. It was usually found that when cases were said to be more or less purely neurotic they might be recognized by the fact that there was no premonition of the vomiting coming on, and also that there was no marked change in the gastric contents. The patients bear the vomitings well, except when they become prolonged, spoken of by Tuckwell as habit vomiting. In a case reported by Gardner some years ago, a child was subject to recurrent vomiting at intervals of 2 or 3 days in a month, lasting for 24 hours at a time. At 11 years the child developed chorea. He thought it very likely that many of these cases of cyclic vomiting were traceable to the underlying neurotic condition which leads to chorea and allied nervous affections. In the one case which he had seen there was a distinct gouty-rheumatic history in the parents, and the child too had an excess of urates in the urine. An interesting feature of the case was that with the recurrence of vomiting there was coincident occurrence of excessive urination. The polyuria amounted to 60 to 80 ounces in the 24 hours. Rumination had been noticed in a boy of 16, of extremely neurotic type. With the greatest ease he could regurgitate his food, chew and swallow it, and he said it tasted as good as at first. Such cases were apt to be of neurotic character, and tended toward idiocy although decided evidences of moral insanity characterized this case. Reference was made to the statement of Max Einhorn that many of these cases are seen in girls, and that the hysterical element may be at the base of many of them. In one girl at the age of puberty the stress of school life caused attacks of vomiting, though her general health was unimpaired.

Dr. D. J. M. Miller said that he thought that a distinction could not

be so clearly drawn between nervous vomiting and biliousness as Dr. Ely had endeavored to do. A great many cases of the so-called bilious vomiting are of the same nature as the cases of recurrent vomiting. He thought the toxic nature of the affection was shown by the fatal cases. He had seen one or 2 cases in which the attack terminated in nephritis. It seemed to him that no treatment was of avail. After the attack had begun he believed that the less given by the mouth the better it was for the patient. Sedative remedies combined with nutrient enemata, are the only ones of value. In one case chloral and bromide were given by the rectum. The patient went to sleep for 12 to 15 hours and upon waking the attack was over. Another case had been treated by bromide and laudanum with a similar result.

Dr. Ely, in closing, said that he agreed with Dr. Griffith in the importance of feeding by the bowel, and with Dr. Scott that the amount of uric acid found in the urine did not prove very much. He thought all were agreed that the cause of the disease was some toxin. He had attempted to prove that this toxin was not from the alimentary tract, but was probably due to faulty metabolism, concerning which but little is known.